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BIOLOGICAL EVALUATION
Spruce Beetle

Fort Apache Indian
Reservation,
Arizona

1973

Branch of Forest Insect and Disease Management
Division of Timber Management
Southwestern Region, USDA, Forest Service
517 Gold Avenue, SW
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INTRODUCTION

For the second consecutive year, spruce beetle populations on the Fort Apache Indian Reservation have continued to decline. The lethal low temperatures, which caused high spruce beetle mortality, occurred in January 1971. Standing tree losses on the 15,000 cruised acres have dropped from 22,800 trees in 1970 to 7,800 in 1972. Standing tree losses will continue to drop during 1973.

In late October 1971, high winds caused both scattered and concentrated windthrow. Within the cruised drainages, there was 1.0 wind-thrown spruce per acre. A total of 88.5% of the windthrow was infested with beetles. Total windthrow loss was 3.5 million board feet. What this means in terms of future standing tree losses is unknown, as there is no system for interpreting beetle populations in windthrow. However, the potential for a beetle population increase is present. The only practical method of prevention is good forest management and the removal of windthrow wherever possible.

METHODS

Cruise Data.--A total of 14,956 acres were cruised: 2,985 in Diamond Creek, 4,685 in Ord Creek, 4,540 in Paradise Creek, and 2,755 in Smith Creek. The cruise was made by Region 3 Forest Service Insect and Disease Management personnel during the summer of 1972.

Plots were on 5-chain intervals along cruise lines, and the lines were 20 chains apart. The variable plot method was used with a 10-basal-area factor. Critical angles were measured with a Spiegel-Relaskop. Only trees infested with spruce beetles in 1972, both standing and wind-thrown, and non-infested windthrow were counted in each plot. Windthrow was placed in or out of the plot by comparing the d.b.h. to a limiting distance table. Trees within each plot were tallied as to d.b.h. in 2-inch diameter classes beginning with 6 inches. The survey coordinate lines and cruise lines were the same as used in past surveys, with the exception that only every other cruise line was used in 1972.

Infestation Trend.--Bark samples were collected in May 1972 from Diamond, Ord, Paradise, and Smith Creek drainages. Bark samples were collected again in August from Paradise and Smith Creek drainages. An approximate 6X6-inch bark and wood sample was removed from the north and south sides of each tree at breast height with a chain saw. The samples were then brought to Albuquerque for examination. Live larvae from the May samples and live adults from the August samples were then converted to number per 0.25 $ft.^2$ (6X6-in.). The average number of larvae or adults was then compared to those in Knight's (1960) sequential sample plan to determine the population trend.

RESULTS

Cruise Data.--During 1972, the beetle infested fewer standing trees than windthrow in each of the cruised drainages (Table 1). Standing trees infested in 1972 ranged from 0.06 trees per acre in Diamond Creek to 0.7 trees per acre in Ord Creek. Table 2 shows tree loss by diameter for both standing and wind-thrown trees. The 8- to 22-inch diameter classes accounted for 88.5% of the total standing tree losses. The 14-inch diameter class was highest with 25% total tree mortality. Standing trees infested in 1972 was estimated to be 7,800.

Spruce windthrow was lowest in Diamond Creek with 0.26 trees per acre and highest in Ord Creek with 1.4 trees per acre (Table 1). Within the cruised drainages, there was an estimated 15,100 wind-thrown spruce trees. The wind-thrown spruce was mostly intermediate in size, with 90% being 8-20 inches in d.b.h. Over half (57%) of the windthrow was less than 16 inches in d.b.h. A total of 12,700, or 88.5%, of these trees were infested with beetles (Table 2). Infested windthrow by individual drainage varied from 75% in Ord Creek to 91% in Smith Creek (Table 1).

The basal area per acre loss of infested standing trees and windthrow is shown in Table 3. Diamond Creek was lowest with a total of 0.4 $ft.^2$ of basal area per acre loss and Ord Creek highest with a 2.8 basal area per acre loss.

The 1971 standing infested trees amounted to a volume loss of 1.7 million board feet. Total windthrow loss was 3.5 million board feet.

Infestation Trend.--Both the May and August bark samples indicated a decreasing population in all drainages, except for Ord Creek (Tables 4 and 5). The Ord Creek samples indicated a static to increasing population.

Table 1.--Cruise data by individual drainage.

Drainage	1972 Beetle-infested trees: Standing	Windthrow	Total infested	% Windthrow infested	Non-infested windthrow	Total windthrow
Diamond	0.06	0.23	0.29	88.5	0.03	0.26
Ord	.7	1.05	1.75	75.0	.35	1.4
Paradise	.61	1.02	1.63	82.2	.22	1.23
Smith	.45	.92	1.37	91.1	.09	1.01

Table 2.--Combined cruise data for cruised area within Diamond, Ord, Paradise, and Smith Creek drainages

D.b.h. (2-in. classes)	No. of Engelmann spruce trees/acre: 1972 Beetle-infested trees: Standing	Standing percentile	Windthrow	Total infested	Non-infested windthrow	Total windthrow	Windthrow percentile
6	0	0	0	0	0	0	0
8	0	0	0.1	0.1	0	0.1	9.9
10	0.04	7.7	.15	.19	0.01	.16	15.8
12	.1	19.2	.12	.22	.04	.16	15.8
14	.13	25.0	.1	.23	.06	.16	15.8
16	.05	9.6	.08	.13	.02	.1	9.9
18	.08	15.4	.12	.2	.03	.15	14.8
20	.03	5.8	.08	.11	0	.08	7.9
22	.03	5.8	.04	.07	0	.04	4.0
24	.04	7.7	.02	.06	0	.02	2.0
26	.01	1.9	.02	.03	0	.02	2.0
28	.01	1.9	.01	.02	0	.01	1.0
30	0	0.2	.01	.01	0	.01	1.0
32	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0
Total	0.52	100.2	0.85	1.37	0.16	1.01	99.9

Table 3.--Basal area/acre losses by individual drainage.

Drainage	1972 Infested standing trees	Windthrow	Total
Diamond	0.08	0.32	0.4
Ord	1.0	1.8	2.8
Paradise	0.9	1.6	2.5
Smith	0.7	1.3	2.0

Table 4.--Number of live larvae/6X6-in. bark sampled collected in May 1972 from trees which were attacked in 1971.

Drainage	No. samples	Live larvae/6X6-in. bark sample		
		Mean	Minimum value	Maximum value
Ord	20	5.4[a]	0	25.7
Paradise	50	1.5[b]	0	10.8
Smith	38	2.4[b]	0	20.6

[a] Static to increasing population.
[b] Decreasing population.

Table 5.--Number of adults/6X6-in. bark sample collected in August 1972 from trees which were attacked in 1971.

Drainage	No. samples	Live adults/6X6-in. bark sample		
		Mean	Minimum value	Maximum value
Paradise	20	0.08[a]	0	0.6
Smith	20	0.6[a]	0	6.5

[a] Decreasing population.

DISCUSSION

Tree losses continued the decline that was initiated by the lethal low temperatures of January 1971 which caused high spruce beetle mortality (Frye, 1971). Beetle-killed trees within the cruised area dropped from a high of 22,800 in 1970 to 7,800 in 1972. Volume losses of standing infested trees dropped from 11 million board feet in 1970 to 1.7 million board feet in 1972 (Frye and Flake, 1972). Windthrow losses amounted to 3.5 million board feet. The 1972 decrease in losses would have occurred even without spruce beetle movement to the windthrow, but to what extent is unknown. Standing tree losses in 1973, with the possible exception of Ord Creek, will continue to decrease.

Windthrow is and will continue to be a dominant factor with the spruce beetle population. What this means in terms of losses following the 1974 flight is unknown because there is no known system for interpreting beetle populations in down material. The windthrow does present a serious potential for a population buildup, as most of the windthrow was infested in 1972. The size of the windthrow, mostly small and intermediate, could limit the beetle production.

Standing tree mortality continued to be highest in the intermediate diameter classes. This was also true for the 1971 cruise.

RECOMMENDATIONS

The only practical recommendation is the practice of sound spruce management and the removal of windthrow where possible.

A limited cruise should be made in 1973 to determine standing tree losses. The windthrow should also be examined for brood production. A definite recommendation cannot be made until after the 1974 beetle flight occurs. It will then be possible to determine the future trend of the beetle.

LITERATURE CITED

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APPENDIXES

Appendix 1.--Summary of the 1972 Diamond Creek cruise.

D.b.h. (2-in. classes)	No. of Engelmann spruce trees/acre						
	1972 Beetle-infested trees				Non-infested windthrow	Total windthrow	Windthrow percentile
	Standing	Standing percentile	Wind-throw	Total infested			
12	0.05	83.3	0.1	0.15	0	0.1	38.5
16	0	0	.06	.06	0.03	.09	34.6
18	0	0	.05	.05	0	.05	19.2
22	0	0	.02	.02	0	.02	7.7
24	.01	16.7	0	.01	0	0	0
Total	0.06	100	0.23	0.29	0.03	0.26	100

Appendix 2.--Summary of the 1972 Ord Creek cruise.

D.b.h. (2-in. classes)	No. of Engelmann spruce trees/acre						
	1972 Beetle-infested trees				Non-infested windthrow	Total windthrow	Windthrow percentile
	Standing	Standing percentile	Wind-throw	Total infested			
6	0	0	0	0	0.1	0.1	7.2
8	0	0	0.06	0.06	.06	.12	8.6
10	0	0	.2	.2	.04	.24	17.3
12	0.19	27.1	.11	.3	.06	.17	12.2
14	.18	25.7	.14	.32	0	.14	10.1
16	.06	8.6	.08	.14	.03	.11	7.9
18	.11	15.7	.18	.29	.04	.22	15.8
20	.07	10.0	.17	.24	0	.17	12.2
22	.04	5.7	.06	.1	0	.06	4.3
24	.02	2.9	.01	.03	.01	.02	1.4
26	.03	4.3	.01	.04	0	.01	0.7
28	0	0.7	.01	.01	0	.01	.7
30	0	0	.01	.01	0	.01	.7
32	0	0	.01	.01	0	.01	.7
Total	.7	100.7	1.05	1.75	.34	1.39	99.8

Appendix 3.--Summary of the 1972 Paradise Creek cruise.

D.b.h. (2-in. classes)	No. of Engelmann spruce trees/acre						
	1972 Beetle-infested trees				Non-infested windthrow	Total windthrow	Windthrow percentile
	Standing	Standing percentile	Wind-throw	Total infested			
6	0	0	0	0	0.11	0.11	8.9
8	0	0	0.13	0.13	0	.13	10.6
10	0.08	13.1	.2	.28	0	.2	16.3
12	.11	18.0	.14	.25	.06	.2	16.3
14	.16	26.2	.12	.28	.02	.14	11.4
16	.06	9.9	.09	.15	0	.09	7.3
18	.11	18.0	.14	.25	0	.14	11.4
20	0	0	.05	.05	.01	.06	4.9
22	.03	4.9	.03	.06	.01	.04	3.2
24	.04	6.6	.03	.07	0	.03	2.4
26	0	0	.03	.03	0	.03	2.4
28	.02	3.3	.03	.05	0	.03	2.4
30	0	0	.01	.01	0	.01	0.8
32	0	0	.01	.01	0	.01	.8
34	0	0	.01	.01	0	.01	.8
Total	0.61	100.1	1.02	1.24	0.22	1.23	99.9

Appendix 4.--Summary of the 1972 Smith Creek cruise.

D.b.h. (2-in. classes)	No. of Engelmann spruce trees/acre						
	1972 Beetle-infested trees				Non-infested windthrow	Total windthrow	Windthrow percentile
	Standing	Standing percentile	Wind-throw	Total infested			
8	0	0	0.2	0.2	0	0.2	19.8
10	0.06	13.3	.13	.19	0	.13	12.9
12	0	0	.13	.13	0.04	.17	16.8
14	.13	28.9	.1	.23	.03	.13	12.9
16	.08	17.8	.1	.18	0	.1	9.9
18	.08	17.8	.08	.16	0	.08	7.9
20	.05	11.1	.05	.1	0	.05	5.0
22	.03	6.7	.03	.06	0	.03	3.0
24	.01	2.2	.04	.05	0	.04	4.0
26	.01	2.2	.05	.06	.01	.06	5.9
30	0	0	0	0	.01	.01	1.0
34	0	0	.01	.01	0	.01	1.0
38	0	0	0	0	0	0	0
Total	0.45	100.1	0.92	1.37	0.09	1.01	100.0

Appendix 5.--Results of 6X6-in. bark samples collected in May 1972 from Engelmann spruce which had been attacked by spruce beetles in 1971.

Drainage	Tree No.	D.b.h.	Side sampled	Sample size ($ft.^2$)	Totals/0.25 $ft.^2$ of bark area					
					No. attacks	Egg gallery length (in.)	Larvae		Adults	
							Live	Dead	Live	Dead
Ord	1	23.9	N	0.29	0	0	0	0	0	0
			S	.34	0.7	5.1	5.1	0	5.1	2.2
	2	20.8	N	.39	.6	11.6	25.7	1.3	1.9	0
			S	.44	2.2	16.9	20.8	3.4	6.2	1.1
	3	24.5	N	.39	.6	8.7	0	6.4	0.6	3.2
			S	.5	.5	2.0	0	0	0	0
	4	12.9	N	.44	.6	5.1	0	0	0	0
			S	.47	0	2.6	13.2	0	.5	0
	5	26.3	N	.34	0	11.1	2.2	3.0	1.5	0.7
			S	.39	.6	4.5	0	0	0	0
	6	16.3	N	.47	.5	10.4	0	0	.5	2.1
			S	.44	1.1	7.3	1.1	3.4	.6	2.2
	7	22.6	N	.36	.7	8.2	0	0	0	4.8
			S	.39	.6	7.1	0.6	0	0	.6
	8	26.4	N	.34	0	0	0	0	0	0
			S	.39	.6	6.4	0	0	9.0	0
	9	13.5	N	.33	0	5.7	14.4	0	.8	0
			S	.35	0	6.4	0	0	0	4.2
	10	21.3	N	.39	.6	5.1	23.8	0	0	1.9
			S	.34	0	.7	0	0	0	0
Paradise	1	17.1	N	.47	1.1	11.2	2.7	0	0	.5
			S	.52	1.4	6.0	10.0	0	0	.5
	2	19.4	N	.54	0	4.5	4.6	0	0	1.4
			S	.49	.5	7.4	0	0	0	0
	3	19.0	N	.43	1.2	8.7	3.5	0	0	.6
			S	.44	1.1	12.0	2.8	0	0	1.7
	4	16.2	N	.44	1.7	13.8	0	2.2	0	.6
			S	.61	0	2.9	0	0	0	0
	5	17.6	N	.5	0	1.5	0	0	0	0
			S	.53	1.4	7.6	4.3	0	0	1.4
	6	14.4	N	.44	.6	3.4	0	0	0	0
			S	.56	.9	8.1	0	0	0	0
	7	16.3	N	.56	.9	3.6	4.4	0.9	0	1.3
			S	.56	.4	8.9	.4	.4	0	0
	8	23.4	N	.53	0	4.3	.5	0	0	.5
			S	.53	.5	11.3	0	11.3	0	.9
	9	15.2	N	.56	.9	5.6	0	1.4	0	1.8
			S	.56	0	0	0	0	0	0

Appendix 5.--Results of 6X6-in. bark samples collected in May 1972 from Engelmann spruce which had been attacked by spruce beetles in 1971 (cont'd.).

Drainage	Tree No.	D.b.h.	Side sampled	Sample size ($ft.^2$)	Totals/0.25 $ft.^2$ of bark area					
					No. attacks	Egg gallery length (in.)	Larvae		Adults	
							Live	Dead	Live	Dead
Paradise	10	20.3	N	0.54	1.4	7.6	1.8	0	0	0.9
			S	.53	0.5	5.7	0.5	0	0	.5
	11	15.4	N	.49	1.0	6.3	0	0	0	1.5
			S	.48	0	2.8	0	1.6	0	1.6
	12	17.6	N	.39	0	8.4	.6	0	0	0
			S	.48	1.0	14.8	0	0	0	0
	13	16.1	N	.45	.6	6.6	.6	0	0	.6
			S	.56	0	5.0	0	0	0	0
	14	18.1	N	.42	1.2	13.3	0	0	0	.6
			S	.56	.4	8.7	1.3	0	0	2.2
	15	20.4	N	.44	0	4.0	0	0	0	0
			S	.44	1.1	7.4	8.6	0	0	1.1
	16	23.3	N	.44	0	6.8	0	0	0	0
			S	.38	1.3	9.3	.7	0	0	0
	17	22.1	N	.44	1.7	9.7	6.3	0	0	1.7
			S	.47	1.1	7.7	4.3	0	0	1.6
	18	18.4	N	.44	.6	13.7	0	0	0	0
			S	.44	0	4.4	0	4.6	0	2.3
	19	22.5	N	.51	1.0	6.3	0	1.9	0	0
			S	.47	1.1	9.6	0	0.5	0	2.1
	20	21.2	N	.41	0	3.1	1.8	0	0	.6
			S	.4	0	3.4	0	.6	0	0
	21	21.1	N	.37	.7	8.0	0	0	0	0
			S	.49	0	8.7	0	0	0	0
	22	22.7	N	.41	1.8	11.6	0	0	0	0
			S	.36	1.4	10.6	0	0	0	0
	23	19.7	N	.39	.6	6.7	0	0	0	.6
			S	.39	.6	5.1	.6	0	0	1.3
	24	15.6	N	.33	0	0	0	0	0	0
			S	.38	0	0	0	0	0	0
	25	17.4	N	.49	1.5	10.5	10.8	0	0	1.5
			S	.52	1.4	10.2	2.9	0	0	0
Smith	1	26.5	N	.32	0	0	0	0	0	0
			S	.39	.6	4.7	1.9	.6	0	0
	2	20.3	N	.36	1.4	1.0	0	0	0	0
			S	.36	1.4	0	0	0	0	0
	3	15.9	N	.49	1.0	6.3	0	.5	0	0
			S	.45	2.8	0	0	0	0	.2

Appendix 5.--Results of 6X6-in. bark samples collected in May 1972 from Engelmann spruce which had been attacked by spruce beetles in May 1971 (cont'd.).

Drainage	Tree No.	D.b.h.	Side sampled	Sample size (ft.^{2})	Totals/0.25 ft.^{2} of bark area					
					No. attacks	Egg gallery length (in.)	Larvae		Adults	
							Live	Dead	Live	Dead
Smith	4	19.0	N	0.47	0	1.6	0	0	0	0.2
			S	.43	2.3	6.7	0	0	0	0
	5	24.0	N	.43	0.6	1.7	6.4	0	0	0
			S	.5	.5	3.9	0	0	0	0
	6	19.6	N	.47	1.6	9.7	1.6	0	0	0
			S	.4	0	4.1	0	0	0	1.9
	7	22.7	N	.36	1.4	10.7	2.1	1.4	0	1.4
			S	.44	.6	4.6	0	0	0	1.1
	8	19.0	N	.29	1.7	13.1	0	0	0	.9
			S	.42	1.2	6.0	0	0	0	0
	9	22.8	N	.39	1.9	7.4	3.8	0.6	0	0
			S	.37	0	0	0	0	0	0
	10	21.9	N	.46	1.6	6.3	0	0	0	0
			S	.47	1.0	8.2	0	0	0	3.7
	11	20.7	N	.5	1.5	8.0	0	0	0	4.0
			S	.42	0	4.2	0	0	0	0
	12	18.0	N	.41	1.8	11.2	0	1.2	0	3.6
			S	.35	0	0	0	0	0	0
	13	18.4	N	.4	.6	14.3	0	1.9	0	5.0
			S	.36	0	5.4	0	0	0	0
	14	21.1	N	.35	0	8.5	3.5	0	0	0
			S	.48	1.0	10.8	2.1	3.2	0.5	0
	15	18.6	N	.41	1.8	13.3	20.6	0	.6	2.4
			S	.4	1.2	10.2	4.3	2.5	0	1.2
	16	27.3	N	.44	1.1	9.6	13.6	2.3	2.8	0
			S	.43	0	2.9	7.0	0	0	0
	17	21.9	N	.47	.5	3.2	2.1	3.2	0	0
			S	.36	.7	8.2	0	0	.7	2.0
	18	20.9	N	.43	3.5	16.8	16.8	7.0	2.3	.6
			S	.36	0	2.4	0	0	0	0
	19	12.5	N	.4	.6	7.4	3.1	2.5	0	1.2
			S	.36	0	2.1	0.7	0	0	0

Appendix 6.--Supplemental results for the 6X6-in. bark samples collected in May 1972 from trees attached in 1971.

Drainage	No. samples	Mean	Minimum value	Maximum value	Standard deviation
		No. attacks/6X6-in. bark sample			
Ord	20	0.5	0	2.2	0.53
Paradise	50	.7	0	1.8	.58
Smith	38	1.0	0	3.5	.86
		Egg gallery length/6X6-in. bark sample			
Ord	20	6.2	0	16.9	4.23
Paradise	50	7.1	0	14.8	3.65
Smith	38	6.2	0	16.8	4.46
		Live larvae/6X6-in. bark sample			
Ord	20	5.4	0	25.7	8.89
Paradise	50	1.5	0	10.8	7.03
Smith	38	2.4	0	20.6	4.78
		Dead larvae/6X6-in. bark sample			
Ord	20	0.9	0	6.4	1.77
Paradise	50	.5	0	11.3	1.75
Smith	38	.7	0	7.0	1.42
		Live adults/6X6-in. bark sample			
Ord	20	1.3	0	9.0	2.49
Paradise	50	0.01	0	0.6	0.08
Smith	38	.2	0	2.8	.6
		Dead adults/6X6-in. bark sample			
Ord	20	1.2	0	4.8	1.53
Paradise	50	0.6	0	2.3	0.74
Smith	38	.8	0	5.0	1.3

Appendix 7.--Results of 6X6-in. bark samples collected in August 1972 from Engelmann spruce which had been attacked by spruce beetles in 1971.

Drainage	Tree No.	D.b.h.	Side sampled	Sample size ($ft.^2$)	Totals/0.25 $ft.^2$ of bark area					
					No. attacks	Egg gallery length (in.)	Larvae		Adults	
							Live	Dead	Live	Dead
Paradise	1	23.1	N	0.48	0.5	1.3	0	0	0	2.6
			S	.36	0	1.0	0	0	0	0
	2	17.9	N	.46	.5	6.2	0	0.5	0	0
			S	.33	.8	10.2	0	0	0	0.8
	3	22.6	N	.39	0	.8	0	0	0	0
			S	.44	0	1.8	0	0	0	1.1
	4	18.5	N	.49	.5	8.7	0	.5	0	.5
			S	.47	.5	2.1	0	0	0	0
	5	24.4	N	.52	1.0	4.1	0	0	0.5	2.9
			S	.38	1.3	4.0	0	0	.6	0
	6	16.0	N	.42	0	0	0	0	0	0
			S	.43	1.2	1.3	0	0	0	.6
	7	32.3	N	.48	2.1	9.9	0	0	0	3.6
			S	.49	1.5	7.7	0	0	0	3.1
	8	21.5	N	.46	0	1.2	0	0	.5	.5
			S	.37	0	2.7	0	0	0	1.3
	9	18.6	N	.39	.6	3.4	0	0	0	3.8
			S	.42	.6	3.7	0	0	0	2.9
	10	25.0	N	.36	0	0	0	0	0	0
			S	.43	0	4.2	0	0	0	0
Smith	1	29.4	N	.29	0	0	0	0	0	0
			S	.34	1.2	2.0	0	0	5.1	1.2
	2	24.6	N	.39	1.6	1.7	0	0	1.9	0
			S	.44	1.9	7.6	0	0	6.2	2.5
	3	27.0	N	.39	5.3	7.0	0	0	.6	2.0
			S	.5	.4	11.2	0	0	0	3.2
	4	26.5	N	.44	.5	4.8	12.7	0	0	1.0
			S	.47	1.7	4.6	16.7	0	.5	.6
	5	24.0	N	.34	3.0	5.5	0	0	1.5	3.0
			S	.39	2.5	6.0	0	0	0	0
	6	21.0	N	.47	1.2	2.4	0	0	.5	1.8
			S	.44	1.4	3.6	2.2	0	.6	1.4
	7	27.1	N	.36	3.2	6.6	0	0	0	1.0
			S	.39	.6	1.8	0	0	0	.6
	8	20.0	N	.34	.6	3.7	0	0	0	0
			S	.39	3.2	8.7	0	0	9.0	1.3
	9	27.1	N	.33	4.3	11.0	0	0	.8	4.9
			S	.35	2.2	11.0	0	0	0	4.4
	10	26.0	N	.39	.6	3.1	0	0	0	.6
			S	.34	.6	4.7	0	0	0	2.5

Appendix 8.--Supplemental results for the 6X6-in. bark samples collected in August 1972 from trees attacked in 1971.

Drainage	No. samples	Mean	Minimum value	Maximum value	Standard deviation
		No. attacks/6X6-in. bark sample			
Paradise	20	0.6	0	2.1	0.6
Smith	20	1.8	0	5.3	1.41
		Inches of egg gallery/6X6-in. bark sample			
Paradise	20	3.7	0	10.2	3.22
Smith	20	5.3	0	11.2	3.3
		Live larvae/6X6-in. bark sample			
Paradise	20	0	-	-	-
Smith	20	1.6	0	16.7	4.56
		Dead larvae/6X6-in bark sample			
Paradise	20	.05	0	0.5	.16
Smith	20	0	-	-	-
		Live adults/6X6-in. bark sample			
Paradise	20	.08	0	.5	.21
Smith	20	.6	0	6.5	1.65
		Dead adults/6X6-in. bark sample			
Paradise	20	1.2	0	3.8	1.4
Smith	20	1.6	0	4.9	2.05